5.1/19 $f(x)=\sqrt[3]{x+2}=(x+2)^{\frac{1}{3}}$

① $f'(x)=\frac{1}{3}(x+2)^{-\frac{2}{3}}(1)=\frac{1}{3\sqrt[3]{(x+2)^2}}$

② – critical numbers

* f' undefined?

$f'(x)$ will not exist when $x+2=0$

i.e. $x=-2$

* $f'=0$

find common denom $\frac{1}{\sim}=\frac{0}{\sim}$

$\frac{1}{3\sqrt[3]{(x+2)^2}}=\frac{0}{1} \Rightarrow 1=0$ impossible

no critical #s.

③ check each critical #

$\rightarrow x=-2$

sign chart of $f'(x)$: + | + at -2

DOOFUS

sign of f' does not change

∴ no relative maximum or minimum.

Phase 2 concavity & second derivative

④ $f'(x)=\frac{1}{3}(x+2)^{-\frac{2}{3}}$

$f''(x)=-\frac{2}{9}(x+2)^{-\frac{5}{3}}(1)=\frac{-2}{9\sqrt[3]{(x+2)^5}}$

⑤ identify POSSIBLE points of inflection

* f'' undefined

$f''(x)$ will be undefined when $(x+2)=0$

so $x=-2$ is a possible p.o.i.

* $f''=0$

not possible

⑥ check each possible point of inflection (poi)

sign chart of $f''(x)$: + + + | – – – at -2 (test values -10, 0); $\frac{-2}{9\sqrt[3]{(x+2)^5}}$

Conclusion: sign of $f''(x)$ changes at $x=-2$ and so the original fn chgs from c-up to c-down at $x=-2$

AND $x=-2$ is the x-coord of a POINT of inflection.

c-up: $(-\infty,-2)$

c-down: $(-2,\infty)$

Nov 14-7:25 AM

5.1/24

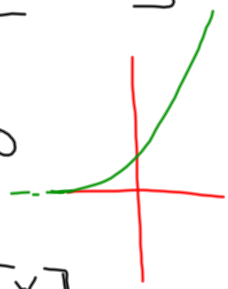
$f(x) = xe^{x^2} = (x)(e^{x^2})$

1) $f'(x) = e^{x^2} + x(e^{x^2})(2x) = e^{x^2}[1+2x^2]$

2) find critical numbers
* always defined
* $f'(x)=0$ when $e^{x^2}[1+2x^2]=0$

$\Rightarrow e^{x^2}=0$ [∅]
or
$1+2x^2=0 \Rightarrow x^2=-\frac{1}{2}$ [∅]

So no critical numbers



③ check . . . → 1st derivative test [sign chart] or 2ND derivative test $f''>0$ or $f''<0$

sign chart of $f'(x)$: $+ \quad + \quad e^{0^2}[1+2(0)^2]=1+ \quad + \quad +$ at 0

function increases on $(-\infty,\infty)$

$\frac{d}{dx}(e^{x^2}) = e^{x^2}\left(\frac{d}{dx}(x^2)\right) = 2xe^{x^2}$

Phase 2

④ find $f''(x)$ $\quad f'(x) = e^{x^2}[1+2x^2]$

$f''(x) = (2xe^{x^2})[1+2x^2] + e^{x^2}[4x]$

$= e^{x^2}[4x^3+6x] = 2xe^{x^2}[2x^2+3]$

⑤ id possible P.O.I.
* f'' is ALWAYS defined [so no possible p.o.i]
* $f''=0$ so $2xe^{x^2}(2x^2+3)=0$

$\to 2x^2+3=0 \Rightarrow x^2=-\frac{3}{2}$ ∅

$\to e^{x^2}=0$ ∅

$\to x=0$:)

$\to 2=0$ bin dat be a jerk

⑥ check possible p.o.i.

sign chart $f''(x)$: $- - - -$ | $x=0$ | $+ + + +$ (test points -10, 0, 10)

$2(-10)e^{(-10)^2}[2(-10)^2+3] = -$

$2(10)e^{(10)^2}[2(10)^2+3] = +$

concavity chgs from down to up at $x=0$

so $x=0$ is a point of inflect.

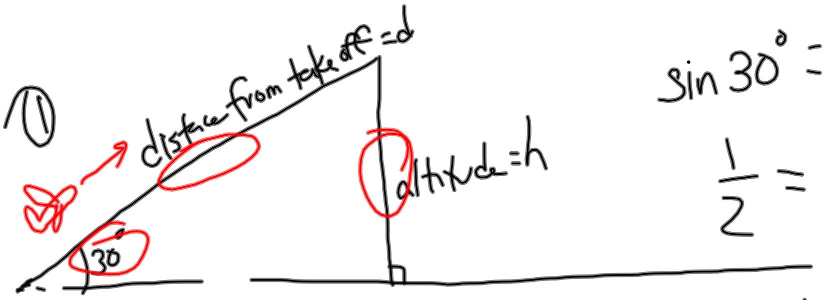
Nov 14-7:25 AM

3.7/29

aircraft climbing at 30°

if speed is 500 mph, how fast is plane climbing?

(1)



$\sin 30° = \frac{h}{d}$

$\frac{1}{2} = \frac{h}{d}$

(2) so $d = 2h$ *

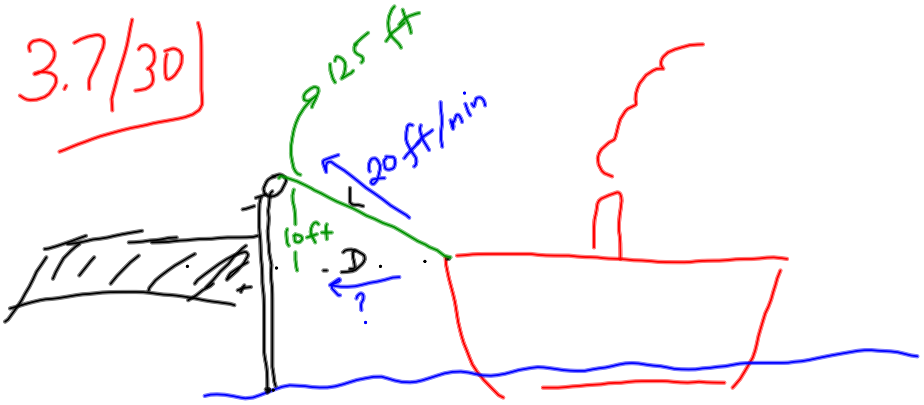
(3) derivative wrt t

$\frac{dd}{dt} = 2\frac{dh}{dt}$ *

(4) $500 \text{ mph} = 2\frac{dh}{dt}$

(5) $\frac{500}{2} \text{mph} = \frac{dh}{dt}$

3.7/30



Doofus

(2) $10^2 + D^2 = L^2$ $D = \sqrt{L^2 - 10^2}$

(3) $2D\frac{dD}{dt} = 2L\frac{dL}{dt}$

$D\frac{dD}{dt} = L\frac{dL}{dt}$

(4) $L = 125$ ft $\frac{dL}{dt} = 20$ ft/min wanna find $\frac{dD}{dt}$

wam - what is D?

$D = \sqrt{125^2 - 10^2} = \sqrt{15525}$

$\sqrt{15525}\,\frac{dD}{dt} = 125(20) = 2500$

$\frac{dD}{dt} = \frac{2500}{\sqrt{15525}}$ ft/min =